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| EXAMINER | |
|---|---|
| FOTAKIS, ARISTOCRATIS | |

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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/800,167 | CAIRNS ET AL. | |
| | Examiner | Art Unit | |
| | ARISTOCRATIS FOTAKIS | 2611 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *07/23/2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *1 - 59* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *39 - 55* is/are allowed.

6)☒ Claim(s) *1 - 2, 5 - 12, 14 - 15, 19 - 23, 25 - 29, 31 - 38 and 56 - 57* is/are rejected.

7)☒ Claim(s) *3 – 4, 13, 16- 18, 24, 30 – 32, 52 - 54, and 58 – 59* is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

## DETAILED ACTION

### *Claim Rejections - 35 USC § 102*

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1 – 2, 5 - 6, 9 – 11, 26, 30 – 31, 35 – 38 and 56 – 57 are rejected under 35 U.S.C. 102(b) as being anticipated by Nielsen (US Pub 2002/0080863).

Re claims 1 and 35, Nielsen teaches of a method of determining received signal impairment correlations using a model comprising one or more model impairment terms ($R_{IND}$, $R_{DEP}$, Paragraph 0034) scaled by corresponding model fitting parameters ($r_0$, 1 – $r_0$), the method comprising: computing the one or more model impairment terms ($R_{IND}$, $R_{DEP}$, Paragraph 0034); measuring received signal impairment correlations ($R_u$, Paragraph 0034); adapting each of the model fitting parameters based on the measured received signal impairment correlations and the one or more model impairment terms using a fitting process (#46, *a process that is repeated for every new SNR in order to determine the optimum scaling factor $r_0$* (see Fig.5) see also Figs.4, 5 and 7,

Paragraphs 0038, 0041 and 0043); and calculating modeled impairment correlations based on the adapted model fitting parameters (using the equation of Paragraph 0035).

Re claim 2, Nielsen teaches of comprising a model that at least includes an interference impairment term scaled by a first fitting parameter ($r_0$) and a noise impairment term scaled by a second fitting parameter ($1 - r_0$) (equation in Paragraph 0035).

Re claim 5, Nielsen teaches of the (r(t), Fig.2) received signal being processed comprises a Wideband Code Division Multiple Access (WCDMA) signal (Paragraph, Lines 9 - 15), and wherein the model fitting parameters are adapted at successive time instants corresponding to WCMDA signal timeslots (n, chip index, Paragraph 0018, Lines 1 - 3) (see claim 3).

Re claim 6, Nielsen teaches of initializing the model by setting the first fitting parameter to zero ($r_0 = 0$, Fig.7, Paragraph 0043, Lines 1 - 10) and setting the second fitting parameter to a positive value (when $r_0 = 0$ then second parameter $1 - r_0$ is a positive “1” which is an estimate of received noise power).

Re claim 9, Nielsen teaches of providing a model of received signal impairment correlations comprises providing an interference correlation matrix scaled by a first model fitting parameter and a noise correlation matrix scaled by a second model fitting parameter (see claim 1), and wherein elements of the interference correlation in the model (#42, Fig.4) are determined from channel estimates (from #32, Fig.2) corresponding to one or more received signals of interest (Paragraph 0025).

Re claim 10, Nielsen teaches of measuring the received signal impairment correlations from the channel estimates (covariance matrices, Paragraph 0035), and wherein adapting the model responsive to recurring measurements as discussed above by computing a plurality of channel estimates (vector h) over each one of repeating time slots (n, chip index, Paragraph 0018, Lines 1 - 3) and calculating updated model fitting parameters (Fig.7, Paragraph 0043) for each slot based on the measured impairment correlations.

Re claim 11, Nielsen teaches of varying a channel estimate (multipath environment) across each slot such that measurements of the impairment correlations taken across the slot reflect changing fading conditions as a result of the changing channel estimation (Fig.2).

Re claim 26, Nielsen teaches of using the modeled signal impairment correlations from the model to generate at least one of RAKE combining weights (Fig 1, #14, Fig.4, #50) for RAKE combining (#16, Fig.1) despread values (#18, Fig.1) of a received signal corresponding to the model.

Re claim 36, Nielsen teaches of a receiver circuit (Figs.1 and 6) to determine received signal impairment correlations for use in received signal processing (Figs.1 – 7), the circuit comprising: an impairment correlation estimator (#40, Fig.4) configured to measure received signal impairment correlations (#44, #42) for a received signal of interest (r(t), Fig.1); and one or more impairment modeling circuits (#50, Fig.4) configured to compute one or more model impairments terms ($R_{IND}$, $R_{DEP}$, Paragraph 0035), implement a model comprising one or more model impairment terms ($R_{IND}$, $R_{DEP}$, Paragraph 0035) scaled by corresponding model fitting parameters ($r_0$, $1 - r_0$), adapt each of the model fitting parameters based on the received signal impairment correlations as provided by the impairment correlation estimator (#46, Fig.4, Paragraph 0038 and Fig.7) and the one or more model impairment terms using a fitting process (#46, *a process that is repeated for every new SNR in order to determine the optimum scaling factor $r_0$* (see Fig.5) see also Figs.4, 5 and 7, Paragraphs 0038, 0041 and 0043), and to calculate modeled impairment correlations based on the adapted model fitting parameters (using the equation of Paragraph 0035).

Re claim 37, Nielsen teaches of the receiver circuit further comprising a RAKE (Fig.1) combining (#16, Fig.1) weight generator (#50, Fig.4) configured to generate RAKE combining weights for RAKE combining despread samples (#20, Fig.1) of the received signal of interest (r(t), Fig.1) based at least in part on the model of received signal impairment correlations (Paragraph 0043, Fig.7).

Re claim 38, Nielsen teaches of the receiver circuit further comprises a Signal-to-Interference Ratio (SIR) estimation circuit (#104, Fig.7) configured to estimate a SIR for the received signal of interest based at least in part on the model of received signal impairment correlations (Paragraphs 0045, 0046).

Re claim 56, Nielsen teaches of a method of received signal processing (Fig.1 – 7) comprising: receiving one or more signals of interest (r(t), Fig.1) during each of a succession of time slots (n, chip index, Paragraph 0018, Lines 1 - 3); generating channel estimates over each time slot (vector h); measuring impairment correlations for the one or more signals of interest (Paragraphs 0034 – 0035); computing one or more model impairment terms ($R_{IND}$, $R_{DEP}$, Paragraph 0034); updating model fitting parameters by fitting the measured impairment correlations to an impairment correlation model using the one or more model impairment terms (#110, #108, Fig.7); and based on the updated model fitting parameters, generating in each time slot at least one of RAKE combining (#16, Fig.1) weights (#34, Fig.2) for combining despread values for

the one or more signals of interest (#14, Fig.1), and signal quality measurements for the one or more signals of interest (#100, Fig.7) (Paragraphs 0043 - 0046).

Re claim 57, Nielsen teaches of updating each term of an impairment correlation model based on the measured impairment correlations comprises updating a modeled interference correlation matrix by updating a corresponding first scaling factor ($r_0$) and updating a modeled noise correlation matrix by updating a corresponding second scaling factor ($1 - r_0$)(Paragraph 0040, Fig.5 and #110, #108, Fig.7).

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

The factual inquiries set forth in *Graham* **v.** *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.

3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 7, 25 and 33 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nielsen in view of Heikkila (US 6,771,690).

Nielsen teaches all the limitations of claim 1 except of providing a combined model for each of two or more received signals of interest.

Heikkila teaches of a method to minimize the mean-square-error of an estimate of an unknown parameter, such as a data symbol transmitted through a channel, such as a WCDMA channel. The method includes steps of (a) replacing a required multiplication of an input signal vector by an inverse covariance matrix, which is one of a total signal covariance matrix or an interference-plus-noise covariance matrix, by linear filtering (#22, Fig.3), wherein directly computed or estimated filter elements of a row or a

column of the inverse covariance matrix, corresponding to time instant i, are used as linear filter coefficients; (b) forming a vector g(i) from the filter outputs, the vector g(i) being estimated element by element using the linear filter; and (c) using the vector g(i) in place of a vector that would have been obtained by directly multiplying the signal vector by the inverse covariance matrix. A summation junction (#26) is provided at the outputs of the pulse shape filters (#24) to provide a combined model of received signal impairment correlations for the two signals of interest (Fig.3).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have used a multi antenna receiver for the benefit of increasing throughput, range and improved error rate performance.

Claims 8 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nielsen in view of Bottomley et al. ("Generalized RAKE Receiver for Interference Suppression", IEEE, August 2000).

Re claims 8 and 23, Nielsen teaches all the limitations of claim 1 except of providing a third fitting parameter included in the model of the received signal impairment correlation.

Bottomley teaches of a received signal (r(t), Fig.2) being processed comprising a wireless communication network signal (WCDMA, Abstract), and wherein providing the model of received signal impairment correlations comprises providing a model that includes two or more of a same-cell interference impairment term ($R_{MUI}$, Fig.1 and

equation 22) scaled by a first fitting parameter ($E_I$, Eq.22), a noise impairment term ($R_n$, Eq.22) scaled by a second fitting parameter ($N_0$), and an other-cell interference ($R_{ISI}$, Eq.22) impairment term scaled by a third fitting parameter ($E_0$) (Page 1539).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have considered a third impairment term of other-cell interference scaled by a third fitting parameter to provide a more accuratesignal impairment correlation measurement.

Claim 34 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nielsen and Bottomley as applied to claim 32 above, and further in view of Zhang (US 7,167,723).

Nielsen and Bottomley teach all the limitations above except of the use of cross antennas.

Zhang teaches of a dual channel redundant wireless network link formed by a Redundant Fixed Wireless Network Link device where two wireless networking radio channel are separated by cross polarization of antenna at same radio frequency (Fig.2), or different radio frequency characteristics.

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have used cross polarization antennas to minimize the cross interference between channels.

Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nielsen in view of Engstrom et al.(US Pub 2001/0036812).

Nielsen teaches all the limitations of claim 11 except of the varying a channel estimate across each slot comprising interpolating channel measurements across the slot such that a channel estimate value is a function of relative positioning within the slot.

Engstrom teaches of bit error rate estimates are used for measuring link quality in a radio telecommunications system (Abstract, Lines 1 – 2). The channel estimates are interpolated according to the position of the symbols in the slot. (Eq 11, Paragraph 0055)

It would have been obvious to one having ordinary skill in the art at the time the invention was made to interpolate channel measurements across the slot such that a channel estimate value is a function of relative positioning within the slot to derive a link quality measurement (Abstract).

Claims 14, 15 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nielsen in view of Smee et al (US Pub 2003/0031234).

Re claims 14 and 15, Nielsen teaches all the limitations of claim 10 except of estimating the noise power.

Smee teaches of a method and apparatus to compute the combiner coefficients for wireless communication systems for a space-time solution (Abstract, Lines 1 – 3). Smee teaches of summing selected diagonal elements of a measured impairment correlation matrix obtained by measuring the impairment correlations (Eq.19, Paragraph 0159, Lines 11 – 14) and subtracting components (Eq.20) from the summed diagonal elements to obtain an estimate of noise power comprises summing main diagonal elements corresponding to on-path RAKE fingers (Paragraph 0163) and subtracting a second value determined by summing main diagonal elements corresponding to off-path RAKE fingers (off-diagonal elements are zero, Paragraph 0175).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to estimate noise introduced to the transmitted signal by the channel (diagonal elements) to effectively decode the transmitted signal (Paragraph 0025).

Re claim 19, Nielsen teaches all the limitations of claim 10 and 39 as well as modeled interference and noise correlation matrices substantially match the measured impairment correlations (#108, Fig.7). However, Nielsen does not teach of performing a least squares fit of the model fitting parameters.

Smee teaches of calculating updated model fitting parameters based on the measured impairment correlations (Paragraph 0052) by performing a minimizing mean square error approach to allow weight combining on a per path basis (Paragraph 0048).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to perform a minimizing mean square error approach to allow weight combining on a per path basis.

Claims 20 – 22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nielsen in view of Love et al. (US Pub 2004/0253955).

Nielsen teaches all the limitations of claim 1 except of maintaining different state values for one or more of the model fitting parameters, so that scaling of the corresponding impairment terms is state dependent.

Love teaches of a wireless communications device (#100, Fig.1) including a primary radio frequency branch (#134) and a diversity branch (#136), which is enabled (*active state*) (HSDPA, Paragraph 0018) and disabled (*inactive*) to balance performance

and *power* consumption. Diversity mode operation of the device is controlled, for example, based on one or more of an estimated channel quality indicator (channel estimation), data reception (WCDMA, Paragraph 0018), data rate, state or mode of the station, estimated signal to noise ratio of a pilot signal (*control information from the base station*), battery power level, distance from a serving cell, among other factors (Abstract).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have used a diversity branch with active and inactive states to reduce power consumption where changes in the channel estimation according to the pilot sent from the base station would result in different impairment terms.

Claims 28 – 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nielsen in view of Taylor et al. (US 7,092,452).

Re claim 28, Nielsen teaches all the limitations of claim 1 except of a combing model corresponding to two or more transmit diversity signals received as signals of interest.

Taylor teaches of a digital receiver automatically detecting and non-coherently demodulating a multiplicity of interfering digitally modulated signals transmitted simultaneously at approximately the same carrier frequency. The receiver includes one or more antenna inputs (e.g., polarization and/or space diverse), a parameter estimator

module, and a multiuser detector for estimating the data transmitted by each interfering signals and adapted to operate with at least one of a MUD algorithm with partially quantized prior information and a MUD algorithm based on prewhitened data (Abstract). The multiuser detector module is configured to operate with the low complexity linear MMSE algorithm and includes a combiner module coupled to the turbo MUD, and is adapted to combine recomputed bit estimates output by the turbo MUD with quantized bit values on a next iteration (Col 3, Lines 25 – 50).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have transmitted diversity signals to the receiver to provide a more accurate model and overcoming the effects of fading outages, and circuit failures.

Re claim 29, Nielsen and Taylor teach all the limitations of claim 28 and 47. Nielsen does not teach of solving for model fitting parameters associated with each signal of interest corresponding to each transmit antenna.

As discussed above in claim 28, Taylor teaches of diversity (CDMA) and the combiner module in the multiuser detector module. The Parameter Estimator (#20, Fig.1) generates outputs that occur once per snapshot and contain parameter estimates for each frame of data in that snapshot. These parameter estimates include estimated signature waveforms (#30) for each diversity port (p), frame (m), and active user. The outputs also include an estimated noise power (#26), which is a scalar that represents

the average power of the noise and a training sequence index (#28) which is a pointer to the location of the training sequence in each frame of the snapshot (#15).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to have solved for model fitting parameters associated with each signal of interest for allowing multiple users to operate in the same communication channel that would accurately separate co-channel signals and reduce complex processing (Col 2, Lines 38 – 41).

***Allowable Subject Matter***

Claims 39 – 55 are allowed.

Claims 3 – 4, 13, 16- 18, 24, 30 – 32, 52 - 54, and 58 – 59 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

***Response to Arguments***

Applicant's arguments filed July 23, 2008 have been fully considered but they are not persuasive.

Applicants submit that Nielsen does not teach or suggest adapting model fitting parameters used to scale model impairment terms to fit the model impairment terms to measured impairment correlations.

Examiner submits that independent claims 1, 35 – 36 and 56 do not recite of the above limitation as argued by the Applicants. Instead the claims recite of adapting each of the model fitting parameters **based on** the measured received signal impairment correlations one or more model impairment terms using a fitting process and calculating modeled impairment correlations **based on** the adapted model fitting parameters.

Nielsen teaches adapting each of the model fitting parameters ($r_0$ *and* $1 - r_0$) based on the measured received signal impairment correlations ($R_u$) and the one or more model impairment terms ($R_{DEP}$, $R_{IND}$) using a fitting process ($r_0$ optimizer). The feedback signal (decision variable z) shown in Figs. 2 and 4 is based on the measured received signal impairment correlations ($R_u$) and the one or more model impairment terms using a fitting process ($r_0$ optimizer from the feedback signal (SNR)). Nielsen calculates modeled impairment correlations based on the adapted model fitting parameters by using the optimum value $r_0$ into the equation of Paragraph 0035.

***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ARISTOCRATIS FOTAKIS whose telephone number is (571)270-1206. The examiner can normally be reached on Monday - Thursday 6:30 - 4.

If attempts to reach the examiner by telephone are unsuccessful, the examiner’s supervisor, Chieh M. Fan can be reached on (571) 272-3042. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Aristocratis Fotakis/

Examiner, Art Unit 2611

/Chieh M Fan/
Supervisory Patent Examiner, Art Unit 2611